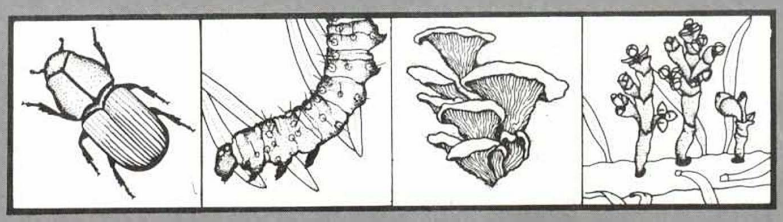
Forest Pest Management



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CONE AND SEED INSECT SURVEYS IN NORTH IDAHO WESTERN WHITE PINE SEED ORCHARDS 1991

by

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INTRODUCTION

Genetically improved blister rust-resistant western white pine seed orchards have been established at several locations in northern Idaho. Cone and seed insects can have a tremendous impact on production of this extremely valuable seed. Losses from 50-75 percent have been recorded in these orchards (Shea et al. 1984, Shea 1985, Haverty et al. 1986). The orchards are monitored throughout the summer to determine the type, abundance, and potential damage caused by the insect pests. The need for, and timing of control are based on these surveys. In an effort to improve the accuracy and efficiency of the surveys, a variety of monitoring methods were evaluated in 1991. In addition, life history information was gathered for the coneworm, one of the important pests. Surveys were conducted at five white pine orchards in 1991: Coeur d'Alene nursery, Lone Mountain, Moscow Arboretum, Grouse Creek, and Priest River.

METHODS

Pheromone traps

Sticky traps with 3 different pheromone blends for the coneworm, *Dioryctria abietivorella* (Grote), were placed in the Coeur d'Alene, Lone Mountain, and Moscow orchards during the first week in May. Pheromone baits were replaced with fresh ones in mid-season. Pheromone traps baited to detect the cone moth, *Eucosma rescissoriana* (Heinrich), were placed for the first time in the Coeur d'Alene and Lone Mountain orchards. They have been routinely placed in the Moscow orchard in previous years. The pheromone traps were placed in the upper crown of white pine trees and attached to a nylon cord pulley system for easy examination from the ground. Between 12 and 20 traps were placed in each orchard and checked weekly. All moths caught were counted and removed.

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Light trap

A battery-operated black light trap was placed in the Coeur d'Alene orchard during the first week in May to attract cone infesting moths. Light traps have been used successfully in the Southeast for monitoring a variety of pine cone-damaging moths including species of *Dioiytria* (Yates III and Eble 1975). The trap was hung between the upper crown of two trees. It had a light-sensitive switch that automatically turned it on at dusk and off at dawn. The trap's catch was collected daily and placed in a freezer for later examination.

Bucket truck observations

A total of 500 cones (10 cones from each of 50 trees) were closely examined at approximately 2-week intervals from a bucket truck at the Coeur d'Alene orchard. All insects seen were recorded.

Ground observations

Cones were examined from the ground with binoculars at monthly intervals at Lone Mountain and Moscow. At Lone Mountain, 250 cones (10 cones from 25 trees) were examined from the high-elevation and mid-elevation orchards (500 total cones). Five hundred cones were also examined at Moscow. At Grouse Creek and Priest River, the trees were short enough to permit close examination of cones from the ground without binoculars. Nearly all cones in these two orchards were examined.

Coneworm rearing

The life history of coneworms is not well understood but it is important to know for correct timing of control measures. In order to get a better idea of which life stage overwinters and where, infested cones were covered with nylon mesh bags the third week in August. Ten cones were bagged at the Coeur d'Alene orchard and 25 cones were bagged at Grouse Creek. The bags were monitored weekly for coneworm emergence. In addition, several infested cones were collected from Coeur d'Alene, Grouse Creek, Priest River, and Lone Mountain in late July and August and brought indoors for rearing.

RESULTS

Pheromone traps

No coneworm adults were caught in any of the pheromone traps even though coneworm damage was observed. This indicates that the pheromone is very unstable or that the pheromone blends used do not attract *D. abietivorella*. In either case, pheromone traps are not a feasible option for monitoring coneworm populations at this time.

Eucosma spp. were caught in the *Eucosma* pheromone traps at Coeur d'Alene and Lone Mountain but specific determination could not be made. Evidently the pheromone will also attract the western pine shoot borer, *E. sonomana* Kearfoot. Both orchards are surrounded by ponderosa pine which could harbor populations of the shoot borer. No damage by *E. rescissoriana* was noted in any cones. Therefore, this pest probably does not exist, or at least is at very low levels in these orchards at this time. The pheromone works well in the Moscow orchard because it is isolated from other forests and the traps are most likely catching the cone moth.

Light trap

Large numbers of insects were caught in the light trap but no cone-infesting insects. We had hoped that the trap would catch adult coneworms but this did not occur. It is possible that the coneworm population was too low or that the trap was not in an infested part of the orchard.

Orchard Examinations

The adelgid, *Pineus coloradensis* (Gillette), and the coneworm, *D. abietivorella* were found in all orchards. Adelgid infestation ranged from 9 percent at Moscow to 96 percent at Grouse Creek. Most cones were lightly infested and ladybugs were observed feeding on the adelgids. The highest infestations of coneworms occurred at Priest River (27 percent) and Grouse Creek (20 percent). Most of the cones examined 1-2 weeks before cone harvest were only partially damaged (less than one-third of the cone) from coneworm feeding. Very little cone moth, *E. rescissoriana*, damage was found in the Moscow orchard. Seed bugs, *Leptoglossus occidentalis* Heidemann, were observed only in the Coeur d'Alene orchard. These insects were seen from the vantage point of a bucket truck. Seed bugs could have been missed at Moscow and Lone Mountain because of the difficulty in detecting them from the ground with binoculars. For specific information taken during each orchard exam, see Appendix A.

Coneworm Rearing

A total of 92 larvae were reared. Most infested cones contained two or more larvae. Thirty-four larvae (37 percent) emerged from cones and spun silk hibernacula on the inside of the bags to overwinter. Larvae emerged from the cones to spin silk between August 26 and September 13. However, most of these larvae were shriveled and dried. Thirty-nine larvae (42 percent) spun a silk chamber on or inside the cone. Most of these appeared healthy and were placed in a cold chamber to rear to adults in the spring. Twelve of the larvae (13 percent) developed into adults before winter. These were all from cones collected and reared in the lab. Seven larvae (8 percent) were parasitized by wasps. The parasites will be sent to specialists for identification.

DISCUSSION AND FUTURE PLANS

The most abundant insect found in all orchards was the adelgid, *P. coloradensis*. No studies have been recorded on the affects of adelgids on cones or seeds. This insect is considered to be a minor pest of white pine cones (Manya Stoetzel, personal communication).

Coneworm damage was found in all orchards. For population monitoring, the lack of moths caught in the pheromone traps and light trap is discouraging. However, in view of the positive light trap results from the southeast, we will try more traps in different locations in the Coeur d'Alene orchard in 1992. From our rearing data, it appears that the majority of the coneworm population overwinters as larvae in silk chambers either in cones or in the duff. This information confirms the necessity of removing all cones from the orchards every year for sanitation purposes.

Seed bugs are considered to be the most important pest at the Coeur d'Alene orchard but damage is not detected until after seed extraction and radiography. Direct observation is the only monitoring method we currently have for seed bugs. They are very mobile and often difficult to see from the ground. Seed bugs lay eggs in rows on the needles of their host trees. In 1992 we will sample seed bug egg masses by clipping branch tips and examining needles. Adult seed bugs congregate to overwinter in houses, bird nests, wood piles, and other protected places. We plan to construct "overwintering boxes" in hopes of attracting them in the fall. Both

egg mass and overwintering adult counts will be correlated with direct seed bug counts during the growing season, and subsequent cone damage.

ACKNOWLEDGEMENTS

Many thanks go to Sue Waltz and Warren Conklin for monitoring the pheromone and light traps at the Coeur d'Alene and Lone Mountain orchards, and for help with the bucket truck observations. Appreciation also goes to Sue Waltz and Aram Eramian for their weekly checks on the bagged cones at Coeur d'Alene and Grouse Creek and to Warren Conklin for installing the light-sensitive switch on the black light trap.

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PERSONAL COMMUNICATIONS

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APPENDIX A

Orchard Examinations

Coeur d'Alene

5/7/91 — 164 cones (33 percent) were lightly infested with an adelgid identified as *Pineus coloradensis*; 14 ladybugs were observed feeding on the adelgids.

5/17/91 — 111 cones (22 percent) were lightly infested with adelgids; 59 ladybugs were observed.

6/3/91 — 77 cones (15 percent) were lightly infested with adelgids; 3 ladybugs were observed; 4 adult western conifer seedbugs, *Leptoglossus occidentalis*; were observed, 2 of which were mating.

6/14/91 — 241 cones (48 percent) were lightly infested with adelgids; 8 ladybugs were observed.

7/3/91 — 43 cones (9 percent) were lightly infested with adelgids; 5 ladybugs were observed; 4 adult seedbugs were observed.

7/15/91 — 47 cones (9 percent) were infested with adelgids; 6 ladybugs were observed; 3 cones were infested with coneworms; 8 adult seedbugs were observed. Numerous giant conifer aphids, *Cinara* spp., were noted on the main stem of several trees.

7/17/91 — The orchard was sprayed with full and half strength concentrations of permethrin (Pounce) aimed at controlling seedbugs.

7/29/91 — 41 cones (8 percent) were infested with adelgids; 1 ladybug was observed; 6 cones were infested with coneworms; 3 seedbug nymphs were found recently hatched from an egg mass.

Lone Mountain

6/10/91 — High elevation - 16 cones (6 percent) were infested with adelgids.
mid-elevation - 20 cones (8 percent) were infested with adelgids. Many trees had branch twigs and new candles heavily infested with adelgids. Numerous crawlers were present which indicate that this would be a good time of year to spray these insects if needed. A lot of needle disease was present in the inner and lower crowns. Many "double" cones (cones with 2 tips) were noticed in both orchards.

7/1/91 — High elevation - 11 cones (4 percent) were infested with adelgids.
mid-elevation - 11 cones (4 percent) were infested with adelgids. Adult and neosistens stages of adelgids were seen on new candles.

8/14/91 — High elevation - 4 cones (2 percent) were infested with coneworms.
mid-elevation - 2 cones (1 percent) were infested with adelgids, 1 with coneworms. Several partially developed, shriveled cones were closely examined but no evidence of insects was found.

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9/4/91 350 cones were examined on the ground after picking; 71 (20 percent) were infested with adelgids and 6 (2 percent) with coneworms.

Moscow Arboretum

5/16/91 The arboretum was aerial sprayed with fenvalerate (Pydrin) to control cone moths.

6/4/91 Only a few cones were found infested with adelgids. No other pests seen.

7/2/91 9 cones (2 percent) were infested with adelgids. No other pests were seen.

7/30/91 45 cones (9 percent) were found infested with adelgids. One cone was infested with *Dioryctria* and 2 with *Eucosma*.

Grouse Creek

5/8/91 A quick walk through revealed several adelgid infested cones. One dead 3 foot tall white pine was infected with armillaria root disease.

6/7/91 The orchard was visited by John Schwandt, Plant Pathologist and Sandy Gast, Entomologist. Armillaria root disease was found on mature ponderosa pine surrounding the white pine orchard. Diseased trees were currently being attacked by the red turpentine beetle, *Dendroctonus valens*(Lec.), and wood borers. Old evidence of the mountain pine beetle, *D. ponderosae* Hopkins, was found in a couple of trees. About 15 dead white pine were examined in the orchard. No more evidence of armillaria was seen. However, roots were found wrapping around each other and many were in the shape of a plug with new roots egressing only from the bottom. Adelgids were found on many cones.

8/15/91 A near 100 percent cruise was conducted on the cones. A total of 364 cones were examined. 287 (96 percent) were infested to some degree by adelgids. Most were very lightly infested. 74 (20 percent) were infested with coneworms.

Priest River

5/7/91 A walk through revealed a light adelgid infestation.

8/14/91 51 cones were observed; 5 (10 percent) were found infested with adelgids. 14 (27 percent) were infested with coneworms. Very light damage was noticed on the trees due to the pine needle sheath miner.